Field Review of the Draft K-12 Grade Span Expectations (GSEs) in Science

Rhode Island Grade Span Expectations K-12 in Science Review – High School

Please Note:
Field Review input needs to be returned to RIDE by Thursday, December 1, 2005.

Please return completed information to:

Pat Kozaczka
RI Department of Education
Office of Instruction
255 Westminster Street
Providence, RI 02903
FAX: 401-222-6033
Pat.Kozaczka@ride.ri.gov

NOTE: You may submit a compilation of comments by attachment electronically to Peter McLaren at peter.mclaren@ride.ri.gov

Any questions regarding Field Review process may be directed to Peter McLaren (Peter.McLaren@ride.ri.gov) at 222-8454 or Linda A. Jzyk (Linda.Jzyk@ride.ri.gov) at 222-8473.

Field Review of the Draft K-12 Grade Span Expectations (GSEs) in Science

Directions:

1) Begin the review process using the field review packet that most closely aligns with the grade level(s) with which you are most familiar. There are three review packets based upon the grade spans that will be used for large-scale assessment (K-4, 5-8, & high school).

2) Complete the Reviewer Information form found on page 2.

3) Read in the GSE packet "*About the Draft Rhode Island K-12 Grade Span Expectations in Science:* to understand how the draft science GSEs were developed and to familiarize yourself with the format of the document and the relationships between the Statements of Enduring Knowledge (EK), the state Assessment Targets, the Unifying Themes, the cross-grade span Stems and the GSEs.

4) Review **Appendix A: GSE Development in Science** for greater understanding of the nature of the science GSEs including the criteria for their design.

5) Read the following questions which form the basis for this field review document:

   Question 1*: Is the GSE articulated in a way that it is clear what is expected of classroom instruction/curriculum and state assessment?*

   Question 2: *Are the differences between the GSEs of adjacent grade spans clear? They should show the appropriate developmental growth as they progress K - high school.*

   Question 3: *Is the GSE more rigorous, similar to, or less rigorous than what is presently expected in your school's science program at that grade span?*

   Question 4: *Does the set of GSEs within each Statement of Enduring Knowledge have the potential to promote coherent instruction? First, is each individual GSE coherent with the Statement of Enduring Knowledge under which it is listed? Second, as a whole, do these GSEs articulate well-balanced coverage of the major concepts within the EK statement? How could they be improved?*

   Question 5: *What science content (important concepts) is missing in these draft science GSEs? Where are there gaps in content? This information is most essential for developing the science GSEs for local curriculum, instruction and assessment.*

6) Locate the grade span you are reviewing in the GSE document. Notice that the GSEs listed in the review packet are detailed, in order, by domain, then by Statement of Enduring Knowledge, and finally by the corresponding assessment target. To help specify the GSE on the review packet, the initial portion of the GSE as listed in the GSE document, has been written next to the GSE number in the review packet.

7) Work through questions 1, 2, and 3 for each GSE within that grade span. Then answer question 4 about the set of GSEs within the Statements of Enduring Knowledge. Notice there is a place to code a response to each question and a place to provide comments.

Rhode Island K-12 Grade Span Expectations in Science – Field Review
Reviewer Information

Name _____

District/Organization: _____

School _____ **or Other** _____

Position: _____

Grade level and or course(s) you are teaching

_____

_____

Number of years in that position _____

Certification(s) _____ _____

_____ _____

E-mail Address: _____

Science Curriculum/textbook used for instruction

_____

Participation on other district and statewide teams (e.g. Science GSE development team, district curriculum committee, school improvement team, peer review team

_____

_____

_____

Question # 1: Clarity of GSE

Is the GSE articulated in a way that it is clear what is expected of classroom instruction/curriculum and state assessment? (Do I understand what learning will be assessed on the state assessment and the related curricular and/or instructional aspects?) If not, what aspect of the GLE needs further clarification? (E.g. clarify terminology, give examples, etc.)

LS1 - All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).

LS1 (9-11) INQ+SAE+FAF -1 Use data and observation to make connections between, to explain, or to justify how specific cell organelles produce/regulate what the cell needs or what a unicellular or multi-cellular organism needs for survival (e.g., protein synthesis, DNA-replication, nerve cells)			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
LS1 (9-11)- 1a explaining the relationships…	○	○	
LS1 (9-11)- 1b explaining that most multi-cellular...	○	○	
	○	○	

LS1 (9-11) FAF+ POC -2 Explain or justify with evidence how the alteration of the DNA sequence may produce new gene combinations that make little difference, enhance capabilities, or can be harmful to the organism (e.g., selective breeding, genetic engineering, mutations).			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
LS1 (9-11) - 2a describing the DNA structure…	○	○	
LS1 (9-11) - 2b explaining how DNA may…	○	○	
LS1 (9-11) - 2c describing how DNA contains …	○	○	

LS2 - Matter cycles and energy flows through an ecosystem.

LS2 (9-11) INQ+SAE -3 Using data from a specific ecosystem, explain relationships or make predictions about how environmental disturbance (human impact or natural events) affects the flow of energy or cycling of matter in an ecosystem.			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
LS2 (9-11)-3a defining and giving an example…	○	○	
LS2 (9-11)-3b describing ways in which…	○	○	
LS2 (9-11)-3c describing ways in which natural…	○	○	

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LS2 - Matter cycles and energy flows through an ecosystem.

LS2 (9-11) POC+ SAE –4 Trace the cycling of matter (e.g., carbon cycle) and the flow of energy in a living system from its source through its transformation in cellular, biochemical processes (e.g., photosynthesis, cellular respiration, [illegible])

GSEs	Curriculum/ Instruction	State Assessment
LS2 (9-11)– 4a diagramming the energy flow…	○	○
LS2 (9-11)– 4b explaining how the chemical…	○	○

Comments

LS2 (9-11) NOS –5 Explain or evaluate potential bias in how evidence is interpreted in reports concerning a particular environmental factor that impacts the biology of humans

GSEs	Curriculum/ Instruction	State Assessment
LS2 (9-11) –5a analyzing claims from…	○	○
LS2 (9-11) –5b making appropriate adjustments…	○	○

Comments

LS3 - Groups of organisms show evidence of change over time (structures, behaviors, and biochemistry).

LS3 (9-11) NOS –6 Explain how evidence from technological advances supports or refutes the genetic relationships among groups of organisms (e.g., DNA analysis, protein analysis.

GSEs	Curriculum/ Instruction	State Assessment
LS3 (9-11)- 6a using data (e.g. diagrams, charts …	○	○

Comments

LS3 (9-11) INQ POC-7 Given a scenario, provide evidence that demonstrates how sexual reproduction results in a great variety of possible gene combinations and contributes to natural selection (e.g., Darwin's finches, isolation of a species, Tay Sach's disease).

GSEs	Curriculum/ Instruction	State Assessment
LS3 (9-11) –7a investigating how information...	○	○
LS3 (9-11) –7b investigating how the sorting …	○	○
LS3 (9-11) –7c citing evidence of how natural …	○	○

Comments

LS3 (9-11) INQ FAF+POC -8 *Given information about living or extinct organisms, cite evidence to explain the frequency of inherited characteristics of organisms in a population, OR explain the evolution of varied structures (with defined functions) that affected the organisms' survival in a specific environment (e.g., giraffe, wind pollination of flowers).*

GSEs	Curriculum/ Instruction	State Assessment
LS3 (9-11) -8a illustrating that when an…	○	○
LS3 (9-11) -8b distinguishing between…	○	○
LS3 (9-11) -8c recognizing patterns in…	○	○
LS3 (9-11) -8d using data or models (charts,…	○	○

Comments

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LS4 - Humans are similar to other species in many ways, and yet are unique among Earth's life forms.

LS4 (9-11) NOS+INQ -9 Use evidence to make and support conclusions about the ways that humans or other organisms are affected by environmental factors or heredity (e.g., pathogens, diseases, medical advances, pollution, mutations).			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
LS4 (9-11) –9a researching scientific …	○	○	
LS4 (9-11) –9b providing an explanation of …	○	○	

LS4 (9-11) SAE+FAF -10 Explain how the immune system, endocrine system, or nervous system works and draw conclusions about how systems interact to maintain homeostasis in the human body.			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
LS4 (9-11)-10a explaining how the roles of the…	○	○	
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Question # 2: Clarity of Grade Span Differences
Are the differences between the GSEs of adjacent grade spans clear? They should show the appropriate developmental growth as they progress K - high school.
NOTE: In some cases, no differences are articulated between the adjacent (corresponding) GSEs. This may be due to increasing difficulty in some related GSE.

LS1 - All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).

LS1 (9-11) INQ+SAE+FAF -1 Use data and observation to make connections between, to explain, or to justify how specific cell organelles produce/regulate what the cell needs or what a unicellular or multi-cellular organism needs for survival (e.g., protein synthesis, DNA-replication, nerve cells)

GSEs	Differences are clear	Differences not clear
LS1 (9-11)- 1a explaining the relationships…	○	○
LS1 (9-11)- 1b explaining that most multicellular...	○	○
LS1 (9-11)- 1c comparing the role of various…	○	○

Comments

LS1 (9-11) FAF+ POC -2 *Explain or justify with evidence how the alteration of the DNA sequence may produce new gene combinations that make little difference, enhance capabilities, or can be harmful to the organism (e.g., selective breeding, genetic engineering, mutations)*

GSEs	Differences are clear	Differences not clear
LS1 (9-11) –2a describing the DNA structure…	○	○
LS1 (9-11) –2b explaining how DNA may be …	○	○
LS1 (9-11) –2c describing how DNA contains …	○	○

Comments

LS2 - Matter cycles and energy flows through an ecosystem.

LS2 (9-11) INQ+SAE -3 Using data from a specific ecosystem, explain relationships or make predictions about how environmental disturbance (human impact or natural events) affects the flow of energy or cycling of matter in an ecosystem.

GSEs	Differences are clear	Differences not clear
LS2 (9-11)-3a defining and giving an example…	○	○
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GSEs	Differences are clear	Differences not clear
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GSEs	Differences are clear	Differences not clear
LS2 (9-11) –5a analyzing claims from…	○	○
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Comments

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LS3 (9-11) NOS –6 Explain how evidence from technological advances supports or refutes the genetic relationships among groups of organisms (e.g., DNA analysis, protein analysis.

GSEs	Differences are clear	Differences not clear
LS3 (9-11)- 6a using data (e.g. diagrams, charts …	○	○

Comments

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GSEs	Differences are clear	Differences not clear
LS3 (9-11) –7a investigating how information...	○	○
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Comments

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GSEs	**Differences are clear**	**Differences not clear**	
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Question 3: Expected Rigor
Is the GSE more rigorous, similar to, or less rigorous than what is presently expected in your school's science program at that grade span?

LS1 - All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).

LS1 (9-11) INQ+SAE+FAF -1 Use data and observation to make connections between, to explain, or to justify how specific cell organelles produce/regulate what the cell needs or what a unicellular or multi-cellular organism needs for survival (e.g., protein synthesis, DNA-replication, nerve cells)

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LS1 (9-11)- 1a explaining the relationships…	○	○	○
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GSEs	More Rigorous	As Rigorous	Less Rigorous
LS1 (9-11) –2a describing the DNA structure…	○	○	○
LS1 (9-11) –2b explaining how DNA may be …	○	○	○
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LS2 (9-11)-3b describing ways in which…	○	○	○
LS2 (9-11)-3c describing ways in which natural…	○	○	○
			○

Comments

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GSEs	More Rigorous	As Rigorous	Less Rigorous
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Comments

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Comments

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LS3 (9-11) –7b investigating how the sorting …	○	○	○
LS3 (9-11) –7c citing evidence of how natural …	○	○	○

Comments

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Comments

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Comments

LS4 (9-11) SAE+FAF -10 Explain how the immune system, endocrine system, or nervous system works and draw conclusions about how systems interact to maintain homeostasis in the human body.

GSEs	More Rigorous	As Rigorous	Less Rigorous
LS4 (9-11)-10a explaining how the roles of the…	○	○	○
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Comments

Question # 4: Does the set of GSEs within each Statement of Enduring Knowledge have the potential to promote coherent instruction? First, is each individual GSE coherent with the Statement of Enduring Knowledge under which it is listed? Second, as a whole, do these GSEs articulate well-balanced coverage of the major concepts within the EK statement? How could they be improved?
Go back and review ALL the GSEs *within* the Statement of Enduring Knowledge looking at them as a "GSE set**."** Does the set of GSEs *within* this statement of enduring knowledge have the potential to promote coherent instruction?

LS1 - All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).

GSEs for this EK Statement coherent as a set	
Yes ○	**No** ○

LS1 (9-11) INQ+SAE+FAF -1 Use data and observation to make connections between, to explain, or to justify how specific cell organelles produce/regulate what the cell needs or what a unicellular or multi-cellular organism needs for survival (e.g., protein synthesis, DNA-replication, nerve cells)

GSEs	Individual coherence with the Statement of Enduring Knowledge	
	Yes	*No*
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LS1 (9-11) –2c describing how DNA contains …	○	○

Comments

LS2 - Matter cycles and energy flows through an ecosystem.

GSEs for this EK Statement coherent as a set	
Yes ○	**No** ○

LS2 (9-11) INQ+SAE -3 Using data from a specific ecosystem, explain relationships or make predictions about how environmental disturbance (human impact or natural events) affects the flow of energy or cycling of matter in an ecosystem.

GSEs	Individual coherence with the Statement of Enduring Knowledge	
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LS2 (9-11)-3a defining and giving an example…	○	○
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LS2 - Matter cycles and energy flows through an ecosystem.

GSEs for this EK Statement coherent as a set
see section above

LS2 (9-11) NOS –5 Explain or evaluate potential bias in how evidence is interpreted in reports concerning a particular environmental factor that impacts the biology of humans

Comments

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LS3 Groups of organisms show evidence of change over time (structures, behaviors, and biochemistry).

GSEs for this EK Statement coherent as a set
Yes ○ **No** ○

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Comments

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Comments

Question # 1: Clarity of GSE

Is the GSE articulated in a way that it is clear what is expected of classroom instruction/curriculum and state assessment? (Do I understand what learning will be assessed on the state assessment and the related curricular and/or instructional aspects?) If not, what aspect of the GLE needs further clarification? (E.g. clarify terminology, give examples, etc.)

PS1 - All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size or amount of substance)

PS1 (9-11) INQ –1 Use physical and chemical properties as determined through an investigation to identify a substance.			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
PS1 (9-11) –1a utilizing appropriate data...	○	○	
PS1 (9-11) –1b determining the pressure ...	○	○	

PS1 (9-11) MAS+ NOS –2 Scientific thought about atoms has changed over time. Using information (narratives or models of atoms) provided, cite evidence that has changed our understanding of the atom and the development of atomic theory.			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
PS1 (9-11)–2a given appropriate prompts (diagrams, charts, narratives, etc.) students...	○	○	

PS1 (9-11) POC –3 Explain how properties of elements and the location of elements on the periodic table are related			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
PS1 (9-11)-3a identifying and explaining the...	○	○	
PS1 (9-11)-3b predicting the relative physical...	○	○	

PS1 (9-11) MAS+ FAF – 4 Model and explain the structure of an atom or explain how an atom's electron configuration, particularly the outermost electron(s), determines how that atom can interact with other atoms			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
PS1 (9-11)–4a comparing the characteristics...	○	○	
PS1 (9-11)–4b writing formulae for compounds...	○	○	
PS1 (9-11)–4c explaining and/or modeling...	○	○	

PS2 - Energy is necessary for change to occur in matter. Energy can be stored, transferred, and transformed, but cannot be destroyed.

PS2 (9-11) POC+SAE-5 Demonstrate how transformations of energy produce some energy in the form of heat and therefore the efficiency of the system is reduced (chemical, biological, and and physical systems).			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
PS2 (9-11)-5a describing or diagraming...	○	○	
...	○	○	

PS2 (9-11) INQ+SAE -6 Using information provided about chemical changes, draw conclusions about and explain the energy flow in a given chemical reaction (e.g., exothermic reactions, endothermic reactions)			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
PS2 (9-11)-6a writing simple balanced...	○	○	
PS2 (9-11)-6b identifying whether a given...	○	○	
PS2 (9-11)-6c explaining and/or modeling...	○	○	
PS2 (9-11)-6d explaining the concept of half-...	○	○	
PS2 (9-11)-6e differentiating between fission...	○	○	

Question # 1: Clarity of GSE

Is the GSE articulated in a way that it is clear what is expected of classroom instruction/curriculum and state assessment? (Do I understand what learning will be assessed on the state assessment and the related curricular and/or instructional aspects?) If not, what aspect of the GLE needs further clarification? (E.g. clarify terminology, give examples, etc.)

PS 2 - Energy is necessary for change to occur in matter. Energy can be stored, transferred, and transformed, but cannot be destroyed.

PS2 (9-11) –SAE – 7 Explain relationships between and among electric charges, magnetic fields, electromagnetic forces, and atomic particles.			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
PS2 (9-11)-7a explaining through words...	○	○	
PS2 (9-11)-7b explaining through words...	○	○	
PS2 (9-11)-7c describing the relationship ...	○	○	

PS3 - The motion of an object is affected by forces.

PS3 (9-11) POC+ INQ 8 *Given information (e.g., graphs, data, diagrams), use the relationships between or among force, mass, velocity, momentum, and acceleration to predict and explain the motion of objects.*			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
PS3 (9-11)-8a predicting and/or graphing...	○	○	
PS3 (9-11)-8b using modeling, illustrating...	○	○	

PS3 (9-11) POC –9 Apply the concepts of inertia, motion, and momentum to predict and explain situations involving forces and motion, including stationary objects and collisions.			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
PS3 (9-11)-9a explaining through words, charts...	○	○	
PS3 (9-11)-9b using Newton's Laws of Motion...	○	○	

PS3 (9-11) SAE –10 Explain the effects on wavelength and frequency as electromagnetic waves interact with matter (e.g., light diffraction, blue sky)			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
PS3 (9-11)–10a investigating examples of wave...	○	○	
PS3 (9-11)–10b comparing and contrasting...	○	○	
PS3 (9-11)–10c qualifying the relationship...	○	○	

Question # 2: Clarity of Grade Span Differences

Are the differences between the GSEs of adjacent grade spans clear? They should show the appropriate developmental growth as they progress K - high school.

NOTE: In some cases, no differences are articulated between the adjacent (corresponding) GSEs. This may be due to increasing difficulty in some related GSE.

PS1 - All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size or amount of substance)

PS1 (9-11) INQ –1 Use physical and chemical properties as determined through an investigation to identify a substance

GSEs	Differences are clear	Differences not clear
PS1 (9-11) –1a utilizing appropriate data...	○	○
PS1 (9-11) –1b determining the pressure ...	○	○

Comments

PS1 (9-11) MAS+ NOS –2 Scientific thought about atoms has changed over time. Using information (narratives or models of atoms) provided, cite evidence that has changed our understanding of the atom and the development of atomic theory.

GSEs	Differences are clear	Differences not clear
PS1 (9-11)–2a given appropriate prompts (diagrams, charts, narratives, etc.) students ...	○	○

Comments

PS1 (9-11) POC –3 Explain how properties of elements and the location of elements on the periodic table are related

GSEs	Differences are clear	Differences not clear
PS1 (9-11)-3a identifying and explaining the...	○	○
PS1 (9-11)-3b predicting the relative physical...	○	○

Comments

PS1 (9-11) MAS+ FAF – 4 Model and explain the structure of an atom or explain how an atom's electron configuration, particularly the outermost electron(s), determines how that atom can interact with other atoms

GSEs	Differences are clear	Differences not clear
PS1 (9-11)–4a comparing the characteristics...	○	○
PS1 (9-11)–4b writing formulae for compounds...	○	○
PS1 (9-11)–4c Explaining and/or modeling...	○	○

Comments

PS2 - Energy is necessary for change to occur in matter. Energy can be stored, transferred, and transformed, but cannot be destroyed.

PS2 (9-11) POC+SAE-5 Demonstrate how transformations of energy produce some energy in the form of heat and therefore the efficiency of the system is reduced (chemical, biological, and and physical systems)

GSEs	Differences are clear	Differences not clear
PS2 (9-11)-5a describing or diagraming...	○	○

Comments

PS2 (9-11) INQ+SAE -6 Using information provided about chemical changes, draw conclusions about and explain the energy flow in a given chemical reaction (e.g., exothermic reactions, endothermic reactions)

GSEs	Differences are clear	Differences not clear
PS2 (9-11)-6a writing simple balanced...	○	○
PS2 (9-11)-6b identifying whether a given...	○	○
PS2 (9-11)-6c explaining and/or modeling...	○	○
PS2 (9-11)-6d explaining the concept of half-...	○	○
PS2 (9-11)-6e differentiating between fission...	○	○

Comments

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PS2 (9-11) –SAE – 7 Explain relationships between and among electric charges, magnetic fields, electromagnetic forces, and atomic particles.

GSEs	Differences are clear	Differences not clear	Comments
PS2 (9-11)-7a explaining through words...	○	○	
PS2 (9-11)-7b explaining through words...	○	○	
PS2 (9-11)-7c describing the relationship ...	○	○	

PS3 - The motion of an object is affected by forces.

PS3 (9-11) POC+ INQ 8 *Given information (e.g., graphs, data, diagrams), use the relationships between or among force, mass, velocity, momentum, and acceleration to predict and explain the motion of objects.*

GSEs	Differences are clear	Differences not clear	Comments
PS3 (9-11)-8a predicting and/or graphing...	○	○	
PS3 (9-11)-8b using modeling, illustrating...	○	○	

PS3 (9-11) POC –9 Apply the concepts of inertia, motion, and momentum to predict and explain situations involving forces and motion, including stationary objects and collisions.

GSEs	Differences are clear	Differences not clear	Comments
PS3 (9-11)-9a explaining through words, charts...	○	○	
PS3 (9-11)-9b using Newton's Laws of Motion...	○	○	

PS3 (9-11) SAE –10 Explain the effects on wavelength and frequency as electromagnetic waves interact with matter (e.g., light diffraction, blue sky)

GSEs	Differences are clear	Differences not clear	Comments
PS3 (9-11)–10a. investigating examples of wave...	○	○	
PS3 (9-11)–10b comparing and contrasting...	○	○	
PS3 (9-11)–10c qualifying the relationship...	○	○	

Question 3: Expected Rigor

Is the GSE more rigorous, similar to, or less rigorous than what is presently expected in your school's science program at that grade span?

PS1 - All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size or amount of substance)

PS1 (9-11) INQ –1 Use physical and chemical properties as determined through an investigation to identify a substance				**Comments**
GSEs	**More Rigorous**	**As Rigorous**	**Less Rigorous**	
PS1 (9-11) –1a utilizing appropriate data...	○	○	○	
PS1 (9-11) –1b determining the pressure ...	○	○	○	

PS1 (9-11) MAS+ NOS –2 Scientific thought about atoms has changed over time. Using information (narratives or models of atoms) provided, cite evidence that has changed our understanding of the atom and the development of atomic theory.				**Comments**
GSEs	**More Rigorous**	**As Rigorous**	**Less Rigorous**	
PS1 (9-11)–2a given appropriate prompts (diagrams, charts, narratives, etc.) students ...	○	○	○	

PS1 (9-11) POC –3 Explain how properties of elements and the location of elements on the periodic table are related				**Comments**
GSEs	**More Rigorous**	**As Rigorous**	**Less Rigorous**	
PS1 (9-11)-3a identifying and explaining the...	○	○	○	
PS1 (9-11)-3b predicting the relative physical...	○	○	○	

PS1 (9-11) MAS+ FAF – 4 Model and explain the structure of an atom or explain how an atom's electron configuration, particularly the outermost electron(s), determines how that atom can interact with other atoms				**Comments**
GSEs	**More Rigorous**	**As Rigorous**	**Less Rigorous**	
PS1 (9-11)–4a comparing the characteristics...	○	○	○	
PS1 (9-11)–4b writing formulae for compounds...	○	○	○	
PS1 (9-11)–4c explaining and/or modeling...	○	○	○	

PS2 - Energy is necessary for change to occur in matter. Energy can be stored, transferred, and transformed, but cannot be destroyed.

PS2 (9-11) POC+SAE-5 Demonstrate how transformations of energy produce some energy in the form of heat and therefore the efficiency of the system is reduced (chemical, biological, and and physical systems)				**Comments**
GSEs	**More Rigorous**	**As Rigorous**	**Less Rigorous**	
PS2 (9-11)-5a describing or diagraming...	○	○	○	

Question 3: Expected Rigor
Is the GSE more rigorous, similar to, or less rigorous than what is presently expected in your school's science program at that grade span?

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PS2 (9-11) INQ+SAE -6 Using information provided about chemical changes, draw conclusions about and explain the energy flow in a given chemical reaction (e.g., exothermic reactions, endothermic reactions)

GSEs	More Rigorous	As Rigorous	Less Rigorous
PS2 (9-11)-6a writing simple balanced...	○	○	○
PS2 (9-11)-6b identifying whether a given...	○	○	○
PS2 (9-11)-6c explaining and/or modeling...	○	○	○
PS2 (9-11)-6d explaining the concept of half-...	○	○	○
PS2 (9-11)-6e differentiating between fission...	○	○	○

Comments

PS2 (9-11) –SAE – 7 Explain relationships between and among electric charges, magnetic fields, electromagnetic forces, and atomic particles.

GSEs	More Rigorous	As Rigorous	Less Rigorous
PS2 (9-11)-7a explaining through words...	○	○	○
PS2 (9-11)-7b explaining through words...	○	○	○
PS2 (9-11)-7c describing the relationship ...	○	○	○

Comments

PS3 - The motion of an object is affected by forces.

PS3 (9-11) POC+ INQ 8 Given information (e.g., graphs, data, diagrams), use the relationships between or among force, mass, velocity, momentum, and acceleration to predict and explain the motion of objects.

GSEs	More Rigorous	As Rigorous	Less Rigorous
PS3 (9-11)-8a predicting and/or graphing...	○	○	○
PS3 (9-11)-8b using modeling, illustrating...	○	○	○

Comments

PS3 (9-11) POC –9 Apply the concepts of inertia, motion, and momentum to predict and explain situations involving forces and motion, including stationary objects and collisions.

GSEs	More Rigorous	As Rigorous	Less Rigorous
PS3 (9-11)-9a explaining through words, charts...	○	○	○
PS3 (9-11)-9b using Newton's Laws of Motion...	○	○	○

Comments

PS3 (9-11) SAE –10 Explain the effects on wavelength and frequency as electromagnetic waves interact with matter (e.g., light diffraction, blue sky)

GSEs	More Rigorous	As Rigorous	Less Rigorous
PS3 (9-11)–10a. investigating examples of wave...	○	○	○
PS3 (9-11)–10b comparing and contrasting...	○	○	○
PS3 (9-11)–10c qualifying the relationship...	○	○	○

Comments

Question # 4: Does the set of GSEs within each Statement of Enduring Knowledge have the potential to promote coherent instruction? First, is each individual GSE coherent with the Statement of Enduring Knowledge under which it is listed? Second, as a whole, do these GSEs articulate well-balanced coverage of the major concepts within the EK statement? How could they be improved?

Go back and review ALL the GSEs *within* the Statement of Enduring Knowledge looking at them as a "GSE set**."** Does the set of GSEs *within* this statement of enduring knowledge have the potential to promote coherent instruction?

PS1 - All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another (independent of size or amount of substance)

GSEs for this EK Statement coherent as a set			
Yes	○	**No**	○

PS1 (9-11) INQ –1 Use physical and chemical properties as determined through an investigation to identify a substance

GSEs	Individual coherence with the Statement of Enduring Knowledge	
	Yes	**No**
PS1 (9-11) –1a utilizing appropriate data...	○	○
PS1 (9-11) –1b determining the pressure ...	○	○

Comments

PS1 (9-11) MAS+ NOS –2 Scientific thought about atoms has changed over time. Using information (narratives or models of atoms) provided, cite evidence that has changed our understanding of the atom and the development of atomic theory.

GSEs	Individual coherence with the Statement of Enduring Knowledge	
	Yes	**No**
PS1 (9-11)–2a given appropriate prompts (diagrams, charts, narratives, etc.) students ...	○	○

Comments

PS1 (9-11) POC –3 Explain how properties of elements and the location of elements on the periodic table are related

GSEs	Individual coherence with the Statement of Enduring Knowledge	
	Yes	**No**
PS1 (9-11)-3a identifying and explaining the...	○	○
PS1 (9-11)-3b predicting the relative physical...	○	○

Comments

PS1 (9-11) MAS+ FAF – 4 Model and explain the structure of an atom or explain how an atom's electron configuration, particularly the outermost electron(s), determines how that atom can interact with other atoms

GSEs	Individual coherence with the Statement of Enduring Knowledge	
	Yes	**No**
PS1 (9-11)–4a comparing the characteristics...	○	○
PS1 (9-11)–4b writing formulae for compounds...	○	○
PS1 (9-11)–4c explaining and/or modeling...	○	○

Comments

PS2 - Energy is necessary for change to occur in matter. Energy can be stored, transferred, and transformed, but cannot be destroyed.

GSEs for this EK Statement coherent as a set			
Yes	○	**No**	○

PS2 (9-11) POC+SAE-5 Demonstrate how transformations of energy produce some energy in the form of heat and therefore the efficiency of the system is reduced (chemical, biological, and and physical systems)

GSEs	Individual coherence with the Statement of Enduring Knowledge	
	Yes	**No**
PS2 (9-11)-5a describing or diagraming...	○	○

Comments

Question # 4: Does the set of GSEs within each Statement of Enduring Knowledge have the potential to promote coherent instruction? First, is each individual GSE coherent with the Statement of Enduring Knowledge under which it is listed? Second, as a whole, do these GSEs articulate well-balanced coverage of the major concepts within the EK statement? How could they be improved?

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PS2 - Energy is necessary for change to occur in matter. Energy can be stored, transferred, and transformed, but cannot be destroyed.	**GSEs for this EK Statement coherent as a set**
	see section above

PS2 (9-11) INQ+SAE -6 Using information provided about chemical changes, draw conclusions about and explain the energy flow in a given chemical reaction (e.g., exothermic reactions, endothermic reactions)

Comments

GSEs	**Individual coherence with the Statement of Enduring Knowledge**	
	Yes	**No**
PS2 (9-11)-6a writing simple balanced...	○	○
PS2 (9-11)-6b identifying whether a given...	○	○
PS2 (9-11)-6c explaining and/or modeling...	○	○
PS2 (9-11)-6d explaining the concept of half-...	○	○
PS2 (9-11)-6e differentiating between fission...	○	○

PS2 (9-11) –SAE – 7 Explain relationships between and among electric charges, magnetic fields, electromagnetic forces, and atomic particles.

Comment

GSEs	**Individual coherence with the Statement of Enduring Knowledge**	
	Yes	**No**
PS2 (9-11)-7a explaining through words...		
PS2 (9-11)-7b explaining through words...		
PS2 (9-11)-7c describing the relationship ...		

PS 3 - The motion of an object is affected by forces.	**GSEs for this EK Statement coherent as a set**	
	Yes ○	**No** ○

PS3 (9-11) POC+ INQ 8 *Given information (e.g., graphs, data, diagrams), use the relationships between or among force, mass, velocity, momentum, and acceleration to predict and explain the motion of objects.*

Comments

GSEs	**Individual coherence with the Statement of Enduring Knowledge**	
	Yes	**No**
PS3 (9-11)-8a predicting and/or graphing...	○	○
PS3 (9-11)-8b using modeling, illustrating...	○	○
...		

PS3 (9-11) POC –9 Apply the concepts of inertia, motion, and momentum to predict and explain situations involving forces and motion, including stationary objects and collisions.

Comments

GSEs	**Individual coherence with the Statement of Enduring Knowledge**	
	Yes	**No**
PS3 (9-11)-9a explaining through words, charts...	○	○
PS3 (9-11)-9b using Newton's Laws of Motion...	○	○

Question # 4: Does the set of GSEs within each Statement of Enduring Knowledge have the potential to promote coherent instruction? First, is each individual GSE coherent with the Statement of Enduring Knowledge under which it is listed? Second, as a whole, do these GSEs articulate well-balanced coverage of the major concepts within the EK statement? How could they be improved?

Go back and review ALL the GSEs *within* the Statement of Enduring Knowledge looking at them as a "GSE set**."** Does the set of GSEs *within* this statement of enduring knowledge have the potential to promote coherent instruction?

PS 3 - The motion of an object is affected by forces.	**GSEs for this EK Statement coherent as a set**	
	Yes ○	

PS3 (9-11) SAE –10 Explain the effects on wavelength and frequency as electromagnetic waves interact with matter (e.g., light diffraction, blue sky)			**Comments**
GSEs	**Individual coherence with he Statement of Enduring Knowledge**		
	Yes	**No**	
PS3 (9-11)–10a, investigating examples of...	○	○	
PS3 (9-11)–10b comparing and contrasting...	○	○	
PS3 (9-11)–10c qualifying the relationship...	○	○	

Question # 1: Clarity of GSE

Is the GSE articulated in a way that it is clear what is expected of classroom instruction/curriculum and state assessment? (Do I understand what learning will be assessed on the state assessment and the related curricular and/or instructional aspects?) If not, what aspect of the GLE needs further clarification? (E.g. clarify terminology, give examples, etc.)

ESS 1 - The earth and earth materials as we know them today have developed over long periods of time, through continual change processes.

ESS1 (9-11) POC– 1 Provided with geologic data (including movement of plates) on a given locale, predict the likelihood for an earth event (e.g., volcanoes, mountain ranges, islands, earthquakes)			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
ESS1 (9-11)-1a plotting the location of mountain...	○	○	

ESS1 (9-11) NOS–2 Trace the development of the theory of plate tectonics or provide supporting geologic/geographic evidence that supports the validity of the theory of plate tectonics			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
ESS1 (9-11)-2a using given data (diagrams, charts, narratives, etc.) to explain how scientific...	○	○	

ESS1 (9-11) SAE+ POC–3 Explain how internal and external sources of heat (energy) fuel geologic processes (e.g., rock cycle, plate tectonics, sea floor spreading)			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
ESS1 (9-11)-3a by explaining how heat (energy)...	○	○	
ESS1 (9-11)-3b explaining how convection...	○	○	
ESS1 (9-11)-3c investigating and explaining...	○	○	
ESS1 (9-11)-3d explaining how the physical...	○	○	
…			

ESS1 (9-11) INQ+POC+ MAS—4 Relate how geologic time is determined using various dating methods (e.g. radioactive decay, rock sequences, fossil records).			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
ESS1 (9-11)-4a comparing the usefulness...	○	○	
ESS1 (9-11)-4b analyzing samples of rock...	○	○	
…			

ESS3 - The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time.

ESS3 (9-11) NOS–5 Explain how scientific theories about the structure of the universe have been advanced through the use of sophisticated technology (e.g., space probes; visual, radio and x-ray telescopes)			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
ESS3 (9-11)-5a using appropriate prompts (diagrams, charts, narratives, etc.) students will...	○	○	

ESS3 (9-11) NOS–6 Provide scientific evidence that supports or refutes the "Big Bang" theory of how the universe was formed			**Comments**
GSEs	**Curriculum/ Instruction**	**State Assessment**	
ESS3 (9-11)-6a using data (diagrams, charts, narratives, etc.) to explain how the "Big Bang"...	○	○	

Question # 2: Clarity of Grade Span Differences

Are the differences between the GSEs of adjacent grade spans clear? They should show the appropriate developmental growth as they progress K - high school.

NOTE: In some cases, no differences are articulated between the adjacent (corresponding) GSEs. This may be due to increasing difficulty in some related GSE.

ESS1 - The earth and earth materials as we know them today have developed over long periods of time, through continual change processes.

ESS1 (9-11) POC– 1 Provided with geologic data (including movement of plates) on a given locale, predict the likelihood for an earth event (e.g., volcanoes, mountain ranges, islands, earthquakes)

GSEs	Differences are clear	Differences not clear
ESS1 (9-11)-1a plotting the location of mountain...	○	○

Comments

ESS1 (9-11) NOS–2 Trace the development of the theory of plate tectonics or provide supporting geologic/geographic evidence that supports the validity of the theory of plate tectonics

GSEs	Differences are clear	Differences not clear
ESS1 (9-11)-2a using given data (diagrams, charts, narratives, etc.) to explain how scientific...	○	○

Comments

ESS1 (9-11) SAE+ POC–3 Explain how internal and external sources of heat (energy) fuel geologic processes (e.g., rock cycle, plate tectonics, sea floor spreading)

GSEs	Differences are clear	Differences not clear
ESS1 (9-11)-3a by explaining how heat (energy)...	○	○
ESS1 (9-11)-3b explaining how convection...	○	○
ESS1 (9-11)-3c investigating and explaining...	○	○
ESS1 (9-11)-3d explaining how the physical...	○	○

Comments

ESS1 (9-11) INQ+POC+ MAS—4 Relate how geologic time is determined using various dating methods (e.g. radioactive decay, rock sequences, fossil records).

GSEs	Differences are clear	Differences not clear
ESS1 (9-11)-4a comparing the usefulness...	○	○
ESS1 (9-11)-4b analyzing samples of rock...	○	○
…		

Comments

ESS3 - The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time

ESS3 (9-11) NOS–5 Explain how scientific theories about the structure of the universe have been advanced through the use of sophisticated technology (e.g., space probes; visual, radio and x-ray telescopes)

GSEs	Differences are clear	Differences not clear
ESS3 (9-11)-5a using appropriate prompts (diagrams, charts, narratives, etc.) students will...	○	○

Comments

ESS3 (9-11) NOS–6 Provide scientific evidence that supports or refutes the "Big Bang" theory of how the universe was formed

GSEs	Differences are clear	Differences not clear
ESS3 (9-11)-6a using data (diagrams, charts, narratives, etc.) to explain how the "Big Bang"...	○	○

Comments

Question 3: Expected Rigor
Is the GSE more rigorous, similar to, or less rigorous than what is presently expected in your school's science program at that grade span?

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GSEs	More Rigorous	As Rigorous	Less Rigorous
ESS1 (9-11)-1a. plotting the location of mountain...	○	○	○

Comments

ESS1 (9-11) NOS–2 Trace the development of the theory of plate tectonics or provide supporting geologic/geographic evidence that supports the validity of the theory of plate tectonics

GSEs	More Rigorous	As Rigorous	Less Rigorous
ESS1 (9-11)-2a using given data (diagrams, charts, narratives, etc.) to explain how scientific...	○	○	○

Comments

ESS1 (9-11) SAE+ POC–3 Explain how internal and external sources of heat (energy) fuel geologic processes (e.g., rock cycle, plate tectonics, sea floor spreading)

GSEs	More Rigorous	As Rigorous	Less Rigorous
ESS1 (9-11)-3a by explaining how heat...	○	○	○
ESS1 (9-11)-3b explaining how convection...	○	○	○
ESS1 (9-11)-3c investigating and explaining...	○	○	○
ESS1 (9-11)-3d explaining how the physical...	○	○	○

Comments

ESS1 (9-11) INQ+POC+ MAS—4 Relate how geologic time is determined using various dating methods (e.g. radioactive decay, rock sequences, fossil records).

GSEs	More Rigorous	As Rigorous	Less Rigorous
ESS1 (9-11)-4a comparing the usefulness...	○	○	○
ESS1 (9-11)-4b analyzing samples of rock...	○	○	○

Comments

ESS3 - The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time

ESS3 (9-11) NOS–5 Explain how scientific theories about the structure of the universe have been advanced through the use of sophisticated technology (e.g., space probes; visual, radio and x-ray telescopes)

GSEs	More Rigorous	As Rigorous	Less Rigorous
ESS3 (9-11)-5a using appropriate prompts (diagrams, charts, narratives, etc.) students will...	○	○	○

Comments

ESS3 (9-11) NOS–6 Provide scientific evidence that supports or refutes the "Big Bang" theory of how the universe was formed

GSEs	More Rigorous	As Rigorous	Less Rigorous
ESS3 (9-11)-6a using data (diagrams, charts, narratives, etc.) to explain how the "Big Bang"...	○	○	○

Comments

Question # 4: Does the set of GSEs within each Statement of Enduring Knowledge have the potential to promote coherent instruction? First, is each individual GSE coherent with the Statement of Enduring Knowledge under which it is listed? Second, as a whole, do these GSEs articulate well-balanced coverage of the major concepts within the EK statement? How could they be improved?

Go back and review ALL the GSEs *within* the Statement of Enduring Knowledge looking at them as a "GSE set**."** Does the set of GSEs *within* this statement of enduring knowledge have the potential to promote coherent instruction?

ESS 1 - The earth and earth materials as we know them today have developed over long periods of time, through continual change processes.

GSEs for this EK Statement coherent as a set

Yes ○ **No** ○

ESS1 (9-11) POC– 1 Provided with geologic data (including movement of plates) on a given locale, predict the likelihood for an earth event (e.g., volcanoes, mountain ranges, islands, earthquakes)

GSEs	Individual coherence within the Statement of Enduring Knowledge	
	Yes	No
ESS1 (9-11)-1a plotting the location of mountain...	○	○

Comments

ESS1 (9-11) NOS–2 Trace the development of the theory of plate tectonics or provide supporting geologic/geographic evidence that supports the validity of the theory of plate tectonics

GSEs	Individual coherence within the Statement of Enduring Knowledge	
	Yes	No
ESS1 (9-11)-2a using given data (diagrams, charts, narratives, etc.) to explain how scientific...	○	○

Comments

ESS1 (9-11) SAE+ POC–3 Explain how internal and external sources of heat (energy) fuel geologic processes (e.g., rock cycle, plate tectonics, sea floor spreading)

GSEs	Individual coherence within the Statement of Enduring Knowledge	
	Yes	No
ESS1 (9-11)-3a by explaining how heat...	○	○
ESS1 (9-11)-3b explaining how convection...	○	○
ESS1 (9-11)-3c investigating and explaining...	○	○
ESS1 (9-11)-3d explaining how the physical...	○	○
…		

Comments

ESS1 (9-11) INQ+POC+ MAS—4 Relate how geologic time is determined using various dating methods (e.g. radioactive decay, rock sequences, fossil records).

GSEs	Individual coherence within the Statement of Enduring Knowledge	
	Yes	No
ESS1 (9-11)-4a comparing the usefulness...	○	○
ESS1 (9-11)-4b analyzing samples of rock...	○	○

Comments

ESS3 - The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time

GSEs for this EK Statement coherent as a set

Yes ○ **No** ○

ESS3 (9-11) NOS–5 Explain how scientific theories about the structure of the universe have been advanced through the use of sophisticated technology (e.g., space probes; visual, radio and x-ray telescopes)

GSEs	Individual coherence within the Statement of Enduring Knowledge	
	Yes	No
ESS3 (9-11)-5a using appropriate …	○	○

Comments

ESS3 - The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time

GSEs for this EK Statement coherent as a set

Yes ○ **No** ○

ESS3 (9-11) NOS–6 Provide scientific evidence that supports or refutes the "Big Bang" theory of how the universe was formed

GSEs	Individual coherence within the Statement of Enduring Knowledge	
	Yes	No
ESS3 (9-11)-6a using data (diagrams, charts, narratives, etc.) to explain how the "Big Bang"...	○	○

Comments

Question #5: What science content (important concepts) is missing in these draft science GSEs? Where are there gaps in content? This information is most essential for developing the science GSEs for local curriculum, instruction and assessment.	
Relevant EK **(Identify by domain and number - ex. LS1)**	**Content/Concepts Needing Inclusion** **(Please provide as much detail as possible)**

Appendix A: GSE Development in Science

Givens:

- GSEs in science are developed in grade spans K-2, 3-4, 5-6, 7-8 and high school.
- High school science GSEs for all students cover the content and skills eligible for the large-scale assessment given at the end of Grade 11.
- Examples of "Extensions" to the high school science GSEs are provided to guide the more in depth study of particular topic and for local curriculum and assessment
- The science GSEs are for state assessment and local curriculum and assessment purposes.
- The science GSEs are aligned with, but not necessarily limited by, existing state frameworks.

Purpose of GSE: The science GSEs are specified for a common, large-scale, state level assessment, and some are identified for local curriculum and assessment option.

Definition of a GSE: A science GSE is a stated objective that is aligned with the Rhode Island science framework and the national science standards, by grade span. A GSE differentiates performance on concepts, skills, or content knowledge between adjacent grade levels and spans, and as a set, leads to focused, coherent, and developmentally appropriate instruction without narrowing the curriculum

Criteria for the Development of GSEs:

1) GSEs in science **must** relate to national science standards, but not be limited by them.

2) GSEs should maintain a balance between a generalizable skill, concept, or piece of knowledge, **and** enough specificity to differentiate skill, concept, or knowledge between adjacent grades, to make it clear to teachers what is to be taught and learned, ***without being so specific that it narrows the curriculum.***

3) GSEs should explicitly indicate cognitive demand (interaction of content and process). There should be a mix of cognitive demands at all grade levels, not an assumption that students in lower grades do less cognitively demanding work. (The verbs used in the construction of the science GSEs are consistent with the Webb's Depth of Knowledge (DOK) levels. Most science GSEs are written at DOK levels 2 and 3) see TABLE 1

4) GSEs should be specific and clear enough to know how they will be assessed.

5) GSEs should contain language that describes expected performance so that a student's achievement in relation to the GSE can be validly assessed for state assessment purposes.

    a. **Not assessable** – E.g., "Students demonstrate an understanding of characteristic properties of matter."

    b. **Assessable** – E.g., Students demonstrate an understanding of characteristic properties of matter by citing evidence (e.g., prior knowledge, data) to support conclusions about why objects are grouped/not grouped together

Criteria for the Development of a *SET* of Grade Span Expectation in Science

- The set of GSEs should be of comparable grain size.
- Concepts, skills, and knowledge should be differentiated between adjacent grade spans.
- The set of GSEs within a domain of science (Life Science, Physical Science, Earth and Space Science) and the Statement of Enduring Knowledge reflects the relative importance as defined by a review of national and state science standards.
- The set of GSEs should promote coherent, focused, developmentally appropriate instruction, as opposed to isolated instruction *just* on topics, facts, or individual skills that need to be covered.
- The set of GSEs should be reasonable to learn adequately (assuming prior learning).
- The set of GSEs should be constructed as a continuum of learning. Success in one grade span should be a good predictor of success in the following year.
- Success on GSEs across multiple years should be a good predictor of performance at the national benchmark years. (i.e., NAEP).

TABLE 1 Sample Descriptors for each of the DOK Levels in Science, based on Webb
(working draft K. Hess, updated September 2005)

Level 1 Recall & Reproduction	Level 2 Skills & Concepts	Level 3 Strategic Thinking	Level 4 Extended Thinking
a. Recall or recognize a fact, term, definition, simple procedure (such as one step), or property b. Demonstrate a rote response c. Use a well-known formula d. Represent in words or diagrams a scientific concept or relationship e. Provide or recognize a standard scientific representation for simple phenomenon f. Perform a routine procedure, such as measuring length g. Perform a **simple** science process or a set procedure (like a recipe) h. Perform a clearly defined set of steps i. Identify, calculate, or measure	a. Specify and explain the relationship between facts, terms, properties, or variables b. Describe and explain examples and non-examples of science concepts c. Select a procedure according to specified criteria and perform it d. Formulate a routine problem given data and conditions e. Organize, represent, and compare data f. Make a decision as to how to approach the problem g. Classify, organize, or estimate h. Compare data i. Make observations j. Interpret information from a simple graph k. Collect and display data	a. Interpret information from a complex graph (such as determining features of the graph or aggregating data in the graph) b. Use reasoning, planning, and evidence c. Explain thinking (beyond a simple explanation or using only a word or two to respond) d. Justify a response e. Identify research questions and design investigations for a scientific problem f. Use concepts to solve non-routine problems/more than one possible answer g. Develop a scientific model for a complex situation h. Form conclusions from experimental or observational data i. Complete a multi-step problem that involves planning and reasoning j. Provide an explanation of a principle k. Justify a response when more than one answer is possible l. Cite evidence and develop a logical argument for concepts m. Conduct a designed investigation n. Research and explain a scientific concept o. Explain phenomena in terms of concepts	a. Select or devise approach among many alternatives to solve problem b. Based on provided data from a complex experiment that is novel to the student, deduct the fundamental relationship between several controlled variables. c. Conduct an investigation, from specifying a problem to designing and carrying out an experiment, to analyzing its data and forming conclusions d. Relate ideas *within* the content area or *among* content areas e. Develop generalizations of the results obtained and the strategies used and apply them to new problem situations
NOTE: If the knowledge necessary to answer an item automatically provides the answer, it is a Level 1.	**NOTE: If the knowledge necessary to answer an item does not automatically provide the answer, then the item is at least a Level 2. Most actions imply more than one step.** **NOTE: Level 3 is complex and abstract. If more than one response is possible, it is at least a Level 3 and calls for use of reasoning, justification, evidence, as support for the response.**		**NOTE: Level 4 activities often require an extended period of time for carrying out multiple steps; however, time alone is not a distinguishing factor if skills and concepts are simply repetitive over time.**